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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/055,896	01/28/2002	Toshiyuki Tohda	925-222	2071

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EXAMINER
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NGUYEN, CUONG QUANG

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 11/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/055,896

Applicant(s)

TOHDA, TOSHIYUKI

Examiner

Cuong Q Nguyen

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) 7 and 8 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 9-14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_ 6) ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

**Claim Rejections - 35 USC § 102**

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4 are rejected under 35 U.S.C. 102(b) as being anticipated by Dhote et al. (US 5,798,903).

Regarding claims 1 and 2, Dhote et al. discloses a semiconductor substrate (22) having a flat upper surface and a capacitor formed on the upper surface of the semiconductor substrate, the capacitor comprising: a lower electrode (including a multi-layer 46, 44, 42, 40, 48), a ferroelectric layer (50) formed on the lower electrode, wherein an upper surface of the ferroelectric layer including a convex region (between two concave regions); and an upper electrode (including a multi-layer 52, 54) formed on the ferroelectric layer and thoroughly covered the concave region. See Dhote et al.'s Fig.2.

### **Claim Rejections - 35 USC § 103**

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6 and 9-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shiga et al. in view of Huang et al. (US 6,218,238).

Regarding claims 1 and 2, Shiga et al. discloses a semiconductor substrate (1) having a flat upper surface and a capacitor formed on the flat upper surface of the semiconductor substrate, the capacitor comprising: a lower electrode (including a layer 2 and a layer 3), a capacitor dielectric (4) formed on the lower electrode, wherein an upper surface of the capacitor dielectric layer including a convex region (between two concave regions); and an upper electrode (5) formed on the capacitor dielectric layer and thoroughly covered the concave region. See Shiga et al.'s Fig.1.

Shiga et al. teaches that the capacitor dielectric is formed of silicon nitride and does not suggest that silicon nitride can be substituted by ferroelectric material.

It is conventional and also taught by Huang et al. that a capacitor dielectric can be formed of silicon nitride or ferroelectric materials. Huang et al.'s col.1 lines 57-59.

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It would have been obvious to one of ordinary skill in the art to form the capacitor dielectric of ferroelectric material instead of silicon nitride as taught by Huang et al. into Shiga et al.'s device because these material are conventional for forming the capacitor dielectric and they are interchangeable. Moreover, the capacitor is formed of ferroelectric would increase the dielectric constant and reduce the dielectric break down.

Regarding claims 3 and 4, a convex region is formed also on an upper surface of lower electrode layer and is thoroughly covered with the capacitor dielectric layer.

Regarding claims 9-12, as shown in Shiga et al.'s Fig.1, the concave or convex region is formed on the upper the ferroelectric layer in a maner such that a non-smooth region on the ferroelectric layer upper surface is not aligned, in a direction perpendicular to a thickness of the ferroelectric layer, with a non-smooth region on the upper electrode upper surface.

Regarding claims 5-6 and 13-14, Shiga et al. does not explicitly teach that a height of the convex region formed on the upper surface of the ferroelectric layer is not greater than half the thickness of the ferroelectric layer and is at least half a thickness of the upper electrode layer; a height of the convex region formed on the upper surface of the ferroelectric layer is half or smaller than the thickness of the ferroelectric layer and is in a range from the same as to half the thickness of the upper electrode layer; and wherein a height of the convex region formed on the upper surface of the lower electrode layer is half or smaller than the thickness of the lower electrode layer and is in a range from the same as to half the thickness of the ferroelectric layer.

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It would have been obvious to one of ordinary skill in the art to provide the convex region having the height as claimed because the height of convex region in the range as claimed, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPTO 233.

Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dhote.

Dhote teaches all the limitations of claims 1-4 as shown above but does not explicitly teach that a height of the convex region formed on the upper surface of the ferroelectric layer is not greater than half the thickness of the ferroelectric layer and is at least half a thickness of the upper electrode layer; a height of the convex region formed on the upper surface of the ferroelectric layer is half or smaller than the thickness of the ferroelectric layer and is in a range from the same as to half the thickness of the upper electrode layer; and wherein a height of the convex region formed on the upper surface of the lower electrode layer is half or smaller than the thickness of the lower electrode layer and is in a range from the same as to half the thickness of the ferroelectric layer.

It would have been obvious to one of ordinary skill in the art to provide the convex region having the height as claimed because the height of convex region in the range as claimed, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPTO 233.

***Response to Arguments***

3. Applicant's arguments with respect to claims 1-6 and 9-14 have been considered but are moot in view of the new ground(s) of rejection.

**Conclusion**

4. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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5. Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 872-9306. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.
6. Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to CUONG Q NGUYEN whose telephone number is (703) 308-1293. The Examiner is in the Office generally between the hours of 6:30 AM to 5:00 PM (Eastern Standard Time) Monday through Thursday.
7. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Eddie Lee who can be reached on (703) 308-1690. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.
8. Any inquiry of a general nature or relating to the status of this application should be directed to the Technology Center Receptionists whose telephone number is 308-0956.



Cuong Nguyen

Primary examiner

11/12/03